

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 816 699 A1

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:

07.01.1998 Bulletin 1998/02

(51) Int. Cl.<sup>6</sup>: F16C 33/78

(21) Application number: 97110749.5

(22) Date of filing: 01.07.1997

(84) Designated Contracting States:

AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC  
NL PT SE

(30) Priority: 05.07.1996 JP 195298/96

(71) Applicants:

- KOYO SEIKO CO., LTD.  
Chuo-ku Osaka 542 (JP)
- Toyo Seal Industries Co., Ltd.  
Ikarugacho, Ikoma-gun, Nara-ken (JP)

(72) Inventors:

- Okumura, Tsuyoshi  
Chuo-ku, Osaka 542 (JP)

• Nakagawa, Yoshitaka

Chuo-ku, Osaka 542 (JP)

- Wakabayashi, Mitsuru,  
c/o Toyo Seal Ind. Co., Ltd.  
Ikoma-gun, Nara-ken (JP)

(74) Representative:

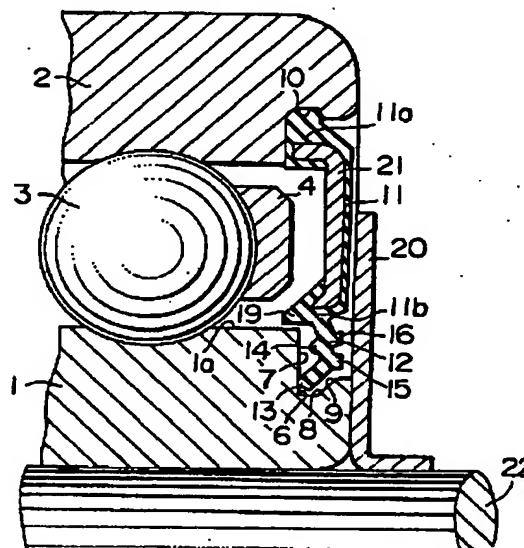
Riederer Freiherr von Paar zu Schönaue, Anton et al

Lederer, Keller & Riederer,  
Postfach 26 64  
84010 Landshut (DE)

### (54) Sealing device for roller bearing

(57) Disclosed is a sealing device for a roller bearing in which a peripheral shoulder portion (6) is provided on a shoulder (5) of an inner ring (1) of the roller bearing, and a part of an inner peripheral seal lip (12) extending from an inner peripheral portion (11b) of a seal annulus (11) secured to an outer ring (2) in a diametrical direction along the side of said peripheral shoulder portion (6) is placed in contact with the side (7) of said peripheral shoulder portion (6). The inner peripheral seal lip of the seal annulus (11) is formed by a plurality of inner lips (13, 14) extending in a direction to the side of the peripheral shoulder portion (6) and a plurality of outer lips (15, 16) extending in the direction opposite thereto. The connecting portions (17, 18) between the inner peripheral portion (11b) of the seal annulus (11) and the inner peripheral seal lip (12) and between the inner lips (13, 14), respectively, extend axially obliquely outwardly. Of the inner lips, only the inner lip (13) at the extreme end always is in contact with the side (7) of the peripheral shoulder portion (6) and the other one(s) come(s) in contact with the side of the peripheral shoulder portion first after the inner lip at the extreme end has been worn to a predetermined amount.

FIG. 1



EP 0 816 699 A1

## Description

### FIELD OF THE INVENTION

The present invention relates to a sealing device for a roller bearing capable of securing sealability for long periods.

### DESCRIPTION OF PRIOR ART

A conventional sealing device for a roller bearing has been known, for example, from U. S. Patent No. 4,191,432 filed by the present Applicant issued on March 4, 1980. The construction of this sealing device for a roller bearing will be described with reference to FIG. 4. A shoulder 41 of an inner ring 40 of a roller bearing is provided with a peripheral shoulder portion 42. An annulus 44 secured to an outer ring 43 is provided with a soft inner peripheral seal lip 45 extending along a side 47 of the peripheral shoulder portion 42. This inner peripheral seal lip 45 is formed at its extreme end with an inner lip 46. The bearing is sealed by the contact of the inner lip 46 with the side 47 of the peripheral shoulder portion 42.

The sealing device as described above involves a problem concerning an interference with respect to the side 47 of the peripheral shoulder and the inner lip 46 of the inner seal lip 45. For example, in the case where the interference becomes excessively large in terms of unevenness of dimension of the inner lip 46 or the displacement of the inner ring, wear of the inner lip 46 occurs early, resulting in a surface contact at the inner surface of the inner peripheral seal lip 45 and not of only the inner lip 46, to lower the lip sliding surface pressure so that foreign matter such as water is likely to enter into the bearing from outside of the bearing. Accordingly, it is necessary to fully and strictly manage the interference of the inner lip 46.

### SUMMARY OF THE INVENTION

It is an object of the present invention to provide a sealing device for a roller bearing capable of securing sealability for long periods even if the wear of a lip due to an excessively large interference should occur.

A sealing device for a roller bearing comprising a peripheral shoulder portion provided on a shoulder of an inner ring; an inner peripheral seal lip extending from an inner peripheral portion of a seal annulus secured to an outer ring in a diametrical direction along the side of said peripheral shoulder portion and having a part thereof placed in contact with the side of said peripheral shoulder portion, said inner peripheral seal lip having a plurality of inner lips extending in a direction to the side of said peripheral shoulder portion, a plurality of outer lips formed to extend from a base of each inner lip in a direction opposite to the side of said peripheral shoulder portion, and connecting portions formed to extend axi-

ally obliquely outwardly between the inner peripheral portion of said seal annulus and the inner peripheral seal lip and between the inner lips, respectively; and sealing means in which, of the inner lips, only the inner lip at the extreme end comes in contact with the side of said peripheral shoulder portion and the other inner lip(s) only come(s) in contact with said peripheral shoulder portion after the first inner lip at the extreme end has been worn to a predetermined extent.

By the provision of the constitution as described above, the present invention causes the inner peripheral seal lip to allow an increase of the amount of axial flexure at the extreme end of the inner peripheral seal lip by a plurality of base points. Further, the wear of the inner lip at the extreme end due to the excessively large interference caused by an axial displacement of the inner ring is hard to occur. Moreover even if the wear should occur the other inner lips come in contact with the side of the peripheral shoulder portion after a predetermined degree of wear to maintain sealability.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of main parts showing one embodiment of a sealing device for a roller bearing according to the present invention.

FIG. 2 is an enlarged view of main parts shown in FIG. 1.

FIG. 3 is a schematic view of the flexure of an inner peripheral seal lip shown in FIG. 1.

FIG. 4 is a longitudinal sectional view of a conventional sealing device for a roller bearing.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiment of the present invention will be described hereinafter with reference to FIGS. 1 and 2. A ball 3 is disposed in a rolling manner between an inner ring 1 having one outer peripheral surface 1a, and an outer ring 2 by means of a retainer 4. The inner ring 1 is formed in its shoulder 5 with an inner side 7 extending in a diametrical direction so as to be perpendicular to an axis, a bottom surface 8 parallel with the axis, and a peripheral shoulder portion 6 having substantially a J-shape in section formed from a taper surface 9 whose diameter increases toward the end of the inner ring 1. The outer ring 2 is formed at an inner peripheral end with a peripheral groove 10, and an outer peripheral portion 11a of a seal annulus 11 is secured to the peripheral groove 10. This seal annulus 11 is constituted from an elastic element such as rubber, in which a diametrically extending metallic core 21 is embedded. The seal annulus 11 is provided at its inner peripheral portion 11b with an axial lip 19 extending inwardly of the bearing to form a labyrinth sealing portion with the outer peripheral surface 1a of the inner ring 1. A soft inner peripheral seal lip 12 formed of an elastic element

extends from the axial lip 19 in a diametrical direction along the side 7 of the peripheral shoulder 5.

The inner peripheral seal lip 12 of the seal annulus 11 is formed at its extreme end and intermediate portion with two inner lips, i. e. a first inner lip 13 and a second inner lip 14, extending in a direction to the side 7 of the peripheral shoulder portion 6. Two outer lips, i. e. a first outer lip and a second outer lip 16, are formed extending in the direction opposite of the side 7 of the peripheral shoulder 5 from positions proximal to the positions of the first inner lip 13 and the second inner lip 14. Connecting portions 17 and 18 between the inner peripheral portion 11b and the second inner lip 14 of the seal annulus 11 and between the second inner lip 14 and the first inner lip 13 are made to be thin in wall-thickness and formed to extend axially obliquely outwardly. Of the inner lips, only the first inner lip 13 at the extreme end always is sealingly in contact with the side 7 of the peripheral shoulder portion 6. The other second inner lip 14 at first is not in contact with the side 7 of the peripheral shoulder portion 6 and comes in contact with the side 7 of the peripheral shoulder portion 6 only after the first inner lip 13 has been worn by a predetermined amount.

That is to say, when the wear of the first inner lip 13 progresses and the lip sliding surface pressure lowers, the second inner lip 14 comes in contact with the side 7 of the peripheral shoulder portion 6 so that the sealability is maintained. This second inner lip 14 prevents a rapid variation of torque when it begins to contact the side 7 of the peripheral shoulder portion 6 as a circular shape in section. The second inner lip 14 forms a labyrinth sealing portion relative to the side 7 till it comes in contact with the side 7 of the peripheral shoulder portion 6.

Since the lips are connected by the thin connecting portions 17, 18 which are inclined axially obliquely outwardly, the connecting portions 17, 18 can be sequentially easily flexed outwardly of the bearing with a thick-wall portion A between the inner peripheral portion 11b of the seal annulus 11, the second inner lip 14 and the second outer lip 16 and a thick-wall portion B between the first inner lip 13 and the first outer lip 15 being base points. Accordingly, since a large amount of axial flexure of the first inner lip 13 is provided, it can correspond to the axial displacement of the inner ring 1. This will be explained with reference to FIG. 3, a schematic view. That is, since the inner seal lip 12 is flexed at angles of  $\theta_1$  and  $\theta_2$  at base points A and B, a large amount L of axial flexure of the first inner lip 13 is easily provided. In FIG. 3, the solid line indicates an original position of the inner peripheral seal lip 12, and the broken line indicates a flexure position.

Accordingly, a proper value of an interference corresponding to the side 7 of the peripheral shoulder portion 6 of the first inner lip 13 is easily maintained. The connecting portions 17 and 18 are formed in parallel and can correspond to the axial displacement of the

inner ring 1 or the like in a further stable manner.

Further, when the inner peripheral surface of the first inner lip 13 is formed on a taper surface 23 opposite to the taper surface 9 of the peripheral shoulder portion 6 to form a labyrinth sealing portion between both the taper surfaces 9 and 23, the sealability is further improved.

Furthermore, when a member such as a slinger 20 pressed and secured to a shaft 22 provided in the inner ring 1 is arranged, a labyrinth sealing portion is formed between the member 20 and the outer lips 15, 16 to further improve the sealing effect.

If a labyrinth sealing portion is formed between the inner lips 13, 14 and the outer lips 15, 16 of the inner peripheral seal lip 12, the sealing effect is further improved.

It is to be noted that the number of the inner lips 13, 14 and of the outer lips 15, 16 of the inner peripheral seal lip 12 need not be limited to two but a plurality of lips will be possible.

#### Claims

1. A sealing device for a roller bearing comprising a peripheral shoulder portion (6) provided on a shoulder (5) of an inner ring (1); an inner peripheral seal lip (12) extending from an inner peripheral portion (11b) of a seal annulus (11) secured to an outer ring (2) in a diametrical direction along the side of said peripheral shoulder portion (6) and having at its radially extreme inner end an inner lip (13) extending in a direction to the side (7) of said peripheral shoulder portion (6) and placed in contact with said side (7) of the peripheral shoulder portion (6), characterized in that said inner peripheral seal lip (12) has a plurality of such inner lips (13, 14), a plurality of outer lips (15, 16) extending from a base of each inner lip in a direction opposite to the side of said peripheral shoulder portion (6), and connecting portions (17, 18) extending axially obliquely outwardly between the inner peripheral portion (11b) of said seal annulus (11) and the inner peripheral seal lip (12) and between the inner lips (13, 14), respectively; wherein of the inner lips, only the inner lip (13) at the extreme end is in contact with the side (7) of said peripheral shoulder portion (6) and the other inner lip(s) (14) only come(s) in contact with said peripheral shoulder portion (6) after the first inner lip (13) at the extreme end has been worn to a predetermined extent.
2. The sealing device for a roller bearing according to claim 1, wherein the connecting portions (17, 18) extend in parallel.
3. The sealing device for a roller bearing according to claim 1 or 2, wherein among the plurality of inner lips, an inner lip (14) other than the first mentioned

inner lip (13) at the extreme end at the beginning forms a labyrinth sealing portion relative to the side (7) of said peripheral shoulder portion (6).

4. The sealing device for a roller bearing according to any of claims 1 to 3, wherein said plurality of outer lips (15, 16) together with a juxtaposed member (20) form a labyrinth sealing portion with respect to the bearing.

10

15

20

25

30

35

40

45

50

55

4

FIG. 1

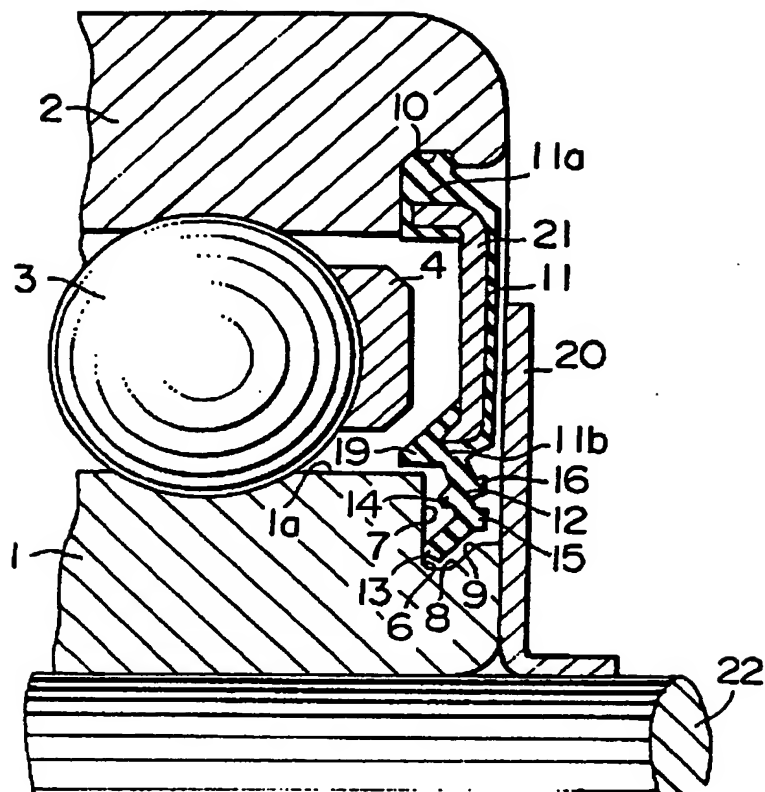


FIG. 2

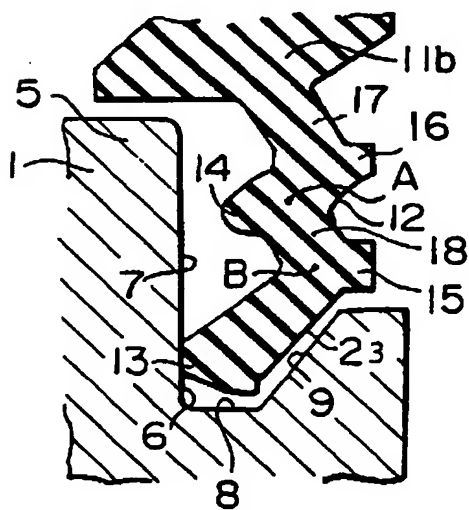


FIG. 3

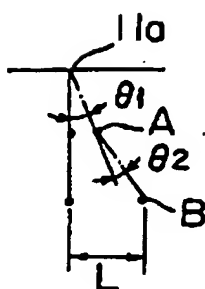
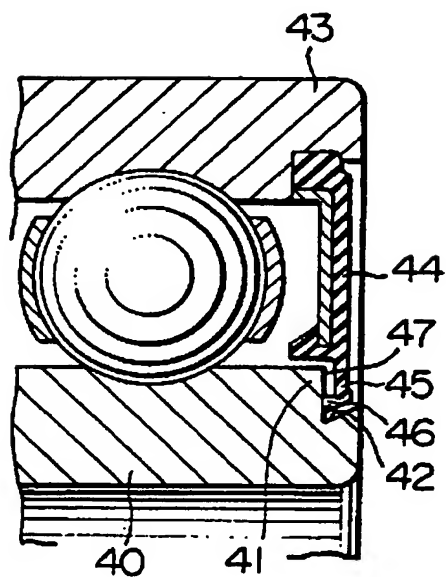


FIG. 4





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 97 11 0749

| DOCUMENTS CONSIDERED TO BE RELEVANT   |  |   |  |
|---|--|---|--|
| Category  | Citation of document with indication, where appropriate, of relevant passages                            | Relevant to claim                                     | CLASSIFICATION OF THE APPLICATION (InCl.6) |
| A   | US 4 505 484 A (OHKUMA TAKEO ET AL) 19 March 1985<br>* the whole document *                              | 1   | F16C33/78                                  |
| D,A   | US 4 191 432 A (FUJITA YOSHIKI ET AL) 4 March 1980<br>* the whole document *                             | 1,4   |  |
| A   | DE 27 31 764 A (STEYR DAIMLER PUCH AG) 26 January 1978<br>* page 4, line 15 - page 5, line 4; figure 2 * | 1,3   |  |
| A   | DE 78 33 808 U (J. WEISSKOPF)<br>* claim 11; figure 3 *  | 1   |  |
|   |  |   | TECHNICAL FIELDS SEARCHED (InCl.6)         |
|   |  |   | F16C                                       |
| The present search report has been drawn up for all claims  |  |   |  |
| Place of search<br>BERLIN   |  | Date of completion of the search<br>30 September 1997 | Examiner<br>Hoffmann, M                    |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |  |   |  |

EPO FORM 1 (03.03.92) (P04231)